REMARKS

This Preliminary Amendment is filed further to the Request for Continued Examination (RCE) filed on August 11, 2003, and prior to a substantive action being issued after the filing of the RCE.

Claims 1-28 are pending in this application. Claims 1, 7, 8, 14, 15, 19 and 22-26 amended herein.

Claims 1, 7, 8, 14, 15 and 19 are independent.

Support for the amendments to claims 1, 7, 8 and 14 can, for example, be found on page 7, line 23, through page 8, line 1, of the present specification. Support for the amendments to claims 15 and 19 can, for example, be found on page 12, lines 7-15. Claims 22-26 are amended in view of the amendments to claims 1, 7, 8 and 14.

Claims 1-28 stand rejected under 35 USC §103(a), as obvious over Hatano et al. (U.S. Patent No. 5,079,184), in view of Sasaki et al. (U.S. Patent No. 6,246,078). The rejections are respectfully traversed for the reasons set forth in the traversal arguments (which are incorporated herein by reference) presented in the responses to the prior official actions, including those set forth in the remarks submitted concurrently with the filing with the above referenced RCE.

Accordingly, the amendments presented herein are not submitted for purposes of patentability. Rather, the present amendments to the independent claims provide additional independent grounds for allowance, and are presented solely for the purpose of expediting issuance of this application.

In accordance with the present invention, the insertion layer is inserted between the p-cladding layer and window layer. The insertion layer of independent claims 1, 7, 8

and 14 prevents a potential barrier between the p-cladding layer and window layer, which would otherwise exist if the insertion layer was not inserted. Furthermore, the insertion layer of independent claims 15 and 19 prevents impurities, which are included in the window layer, from diffusing into the active layer.

As will be discussed further below, it is respectfully submitted that although the Examiner, in the final Official Action, states that it would have been obvious to modify Hatano's laser with the window layer of Sasaki to provide a LED, there is nothing within either reference, or otherwise, to motivate such a modification. Indeed, the combination as proposed by the Examiner is inconsistent with the applied prior art's own teachings. Furthermore, the Examiner asserts that the applied art as discloses various features and limitations of the claimed invention, without identifying any teaching or suggestion of such features or limitations within the references themselves. To the extent the rejection is maintained, the Examiner is again respectfully requested to provide affidavits, as required by the Regulations, in support of the asserted conclusions.

More particularly, claims 1, 7, 8 and 14 require, *inter alia*, an active layer formed of compound semiconductor of AlGaInP system, a p-type cladding layer formed of compound semiconductor of AlGaInP system, and an insertion layer inserted between the p-type cladding layer and a p-type window layer. Each of the active layer and the insertion layer has a smaller band gap energy than the p-type cladding layer. Furthermore, the insertion layer functions to lower a forward voltage of the LED.

Claims 15 and 19 require, *inter alia*, an active layer formed of compound semiconductor of AlGaInP system, a p-type cladding layer formed of compound semiconductor of AlGaInP system, and an insertion layer formed of compound

semiconductor of AlGaInP system inserted into the p-type cladding layer or between the p-type cladding layer and a p-type window layer doped with Zn. The active layer has a smaller band gap energy than the p-type cladding layer. The insertion layer is lattice-matched with the p-type cladding layer and has a composition ratio of Al lower than that in the p-type cladding layer and higher than that in the active layer. Furthermore, the insertion layer functions to prevent impurities from diffusing into the active layer.

Hatano, in column 6, lines 12 to 14, discloses that "the clad layer 47 has a low Al content and serves as an etch stopping layer". Hatano fails to disclose that the clad layer 47 could beneficially perform any function other than etch stopping. In this regard, an etch stopping layer is conventionally used to prevent lower layers from being etched, when a ridge portion of laser is formed. Etch stopping layers are not conventionally used by those skilled in the art to lower a forward voltage of the LED or prevent impurities from diffusing into the active layer, and there is nothing in the applied prior art which would suggest otherwise. It is respectfully submitted that, in view of what is expressly disclosed within the prior art, the Examiner's contention that Hatano's etch stopping layer could function to reduce the potential barrier and impurity diffusion can only be based either on a hindsight reconstruction using the present specification as a guide or pure speculation.

Additionally, if the laser of Hatano is modified with the window layer of Sasaki to provide an LED, there is no need for the clad layer 47 (etch stopping layer). This is because the resulting LED does not require a ridge portion to be formed, and therefore has no need for the etch stopping layer 47. In other words, it is unnecessary to insert the etch stopping layer 47 between the window layer and the p-cladding layer in the

proposed combination. Furthermore, those skilled in the art would recognize there are benefits to be obtained by eliminating the unnecessary etch stopping layer 47 from the proposed LED structure, such as potential enhancement of the characteristics of LED and/or reduction in the manufacturing cost of LED. On the other hand, retaining the etch stopping layer would result in a potential degradation of the LED characteristics and increased manufacturing costs without any off-setting benefit.

Accordingly, even if the proposed modification of Hatano in view of Sasaki were motivated (which it is respectfully submitted is not the case), the modified structure would have no need for the clad layer 47 described by Hatano, and hence no need for the layer which the Examiner alleges to correspond to the claimed insertion layer.

Moreover, to include clad layer 47 in the modified structure would be inconsistent with Hatano's express teaching that the clad layer 47 is only used for etch stopping and only functions as an etch stop. Since there is no need for etch stopping in an LED, Hatano's express teachings suggest that the clad layer 47 should not be inserted in the LED.

Other claimed features further and independently distinguish over the applied prior art. For example, Hatano has an express objective of avoiding Zn doping. Hence, the Examiner's proposed modification of Hatano to include a p-type window layer doped with Zn would result in Hatano being unable to meet its stated objective,

In summary, the applied combination of art lacks numerous recited features and limitations including, but not necessarily limited to, the following:

An active layer formed of compound semiconductor of AlGaInP system, a p-type window layer formed of GaP, and an insertion layer (i) which is inserted between a

p-type cladding layer and a p-type window layer, (ii) has a smaller band gap energy than that of the p-type cladding layer, and (iii) lowers a forward voltage of the LED, as required by independent claims 1, 7, 8 and 14.

An insertion layer with a band gap energy larger than that of an active layer, as required by claims 2 and 9.

An insertion layer with a concentration of carriers of $5X10^{17}cm^{-3}$ to $5X10^{18}cm^{-3}$ as required by claims 4 and 11.

An insertion layer which is lattice-matched with the p-type cladding layer, as required by claims 5 and 12.

An insertion layer which has such a composition that its band gap energy is smaller than that of a p-type cladding layer, as required by claims 6 and 13.

An active layer formed of compound semiconductor of AlGaInP system, a p-type window layer doped with Zn, and an insertion layer which (i) is inserted into a p-type cladding layer or between a p-type cladding layer and a p-type window layer, (ii) is lattice-matched with the p-type cladding layer, (iii) prevents impurities from diffusing into the active layer and (iv) has a composition ratio of Al lower than that in the p-type cladding layer and higher than that in the active layer, as required by independent claims 15 and 19.

A p-type cladding layer doped with Zn, as required by claims 17 and 21.

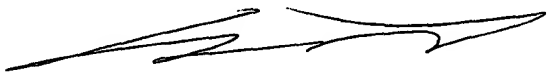
An insertion layer with a concentration of carriers of $2X10^{17}cm^{-3}$ to $5Xl0^{18}cm^{-3,}$ as required by claims 18 and 22.

An insertion layer which lowers the forward voltage between the p-type cladding layer and the window layer, as required by claims 23-28.

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance and an early indication of the same is courteously solicited. The Examiner is respectfully requested to contact the undersigned by telephone at the below listed local telephone number, in order to expedite resolution of any remaining issues and further to expedite passage of the application to issue, if any further comments, questions or suggestions arise in connection with the application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 01-2135 and please credit any excess fees to such deposit account.

Respectfully submitted,
ANTONELLI, TERRY, STOUT & KRAUS, LLP



Alfred A. Stadnicki
Registration No. 30,226

AAS/led
1300 N. 17th Street
Suite 1800
Arlington, Virginia 22209
Telephone: 703-236-6080
Facsimile: 202-296-1682
DATE: September 10, 2003